7.6 Maintenance

Safety Criterion: 7.6 - 1

A maintenance program for the facility shall be developed and implemented using a tailored approach.

Implementing Codes and Standards:

~~BNFL-5193-ISP-01 TWRS-P Project Integrated Safety Management Plan~~
~~Section: 4.2.1 Engineered Features~~
BNFL-5193-SRD-01 TWRS-P Project Safety Requirements Document
Appendix * Implementing Standard for Maintenance

Safety Criterion: 7.6 - 2

The maintenance program shall contain provisions sufficient to preserve, predict, and restore the availability, operability, and reliability of structures, systems, and components designated as important to Safety.

Implementing Codes and Standards:

~~BNFL-5193-ISP-01 TWRS-P Project Integrated Safety Management Plan~~
~~Section: 3.13 Reliability, Availability, Maintainability, and Inspectability (RAMI)~~
BNFL-5193-SRD-01 TWRS-P Project Safety Requirements Document
Appendix * Implementing Standard for Maintenance

Regulatory Basis:

29 CFR 1910 Occupational Safety and Health Standards Location: 119 (j) (5)
DOE/RL-96-0006 4.3.5.1 Operational Testing, Inspection, and Maintonance-Operational Testing, Inspection, and

Safety Criterion: 7.6 - 3

The maintenance program for important to Safety Structures, systems and components shall clearly define:
(1) The Important to Safety structures, systems, and components that comprise the facility;
(2) The requirements of the maintenance program that are derived from the program elements listed in Safety Criterion 7.6-4.
(3) The management systems used for those activities, including the means for monitoring and measuring the effectiveness of the program and the management of maintenance backlog;
(4) The assignment of responsibilities and authority for all levels of the maintenance organization,
(5) Mechanisms to feedback such relevant information as trend analysis and instrumentation performance/reliability data in order to identify necessary program modifications,
(6) Provisions for identifying and evaluating possible component, system design, occupational safety and health, or other relevant problems and implementation of a self-assessment program;
(7) Performance indicators and criteria to be utilized to measure equipment, systems, and personnel effectiveness in maintenance activities;
(8) Interfaces between maintenance and other organizations (e.g., involving operations, engineering, quality, and safety); and
(9) Quantitative reliability target values for systems and components to start or run, when such values are credited in safety analysis.
(10) Appropriate authorization is received before modification starts on a safety instrumented system.
(11) Assessment of impact of the modification on the functionality of the safety instrumented system is performed, to ensure functionality is not impaired.

* Next available appendix number when incorporated into SRD

Implementing Codes and Standards:

~~BNFL-5193-ISP-01-TWRS-P Project Integrated Safety Management Plan~~
~~Section 1.3.10 Classification of Structures, Systems, and Components~~
~~Section 3.2 Safety Responsibilities~~
~~Section 3.4 Safety/Quality Culture~~
~~Section 3.13 Reliability, Availability, Maintainability, and Inspectability (RAMI)~~
~~Section 3.16.3 Incident Investigations~~
~~Section 3.16.5 Performance Monitoring~~
~~Section 3.16.6 Performance Indicators~~

~~Section: 3.15.8 Feedback and Trending~~
~~Chapter: 10.0 Assessments~~
BNFL-5193-SRD-01 TWRS-P Project Safety Requirements Document
Appendix * Implementing Standard for Maintenance
~~BNFL-5193-SRD-01, Attachment~~ Appendix A Implementing Standard for Safety Standards and Requirements Identification

Regulatory Basis:

DOE/RL-96-0006 4.2.7.1 Reliability, Availability, Maintainability, and Inspectability(RAMI)-Reliability
DOE/RL-96-0006 4.3.5.1 Operational Testing, Inspection, and Maintenance-Operational Testing, Inspection, and Maintenace

Safety Criterion: 7.6 - 4

The maintenance program shall address each of the following elements:
(1) Organization and administration;
(2) Maintenance training and qualification;
(3) Maintenance facilities, equipment, and tools;
(4) Types of maintenance;
(5) Maintenance procedures and other work-related documents;
(6) Planning, scheduling, and coordinating maintenance activities;
(7) Control of maintenance activities;
(8) Postmaintenance testing;
(9) Procurement of parts, materials, and services;
(10) Material receipt, inspection, handling, storage, retrieving, and issuance;
(11) Control and calibration of measuring and test equipment;
(12) Maintenance tools and equipment control;
(13) Documented facility condition inspections to identify and address aging effects;
(14) Management involvement with facility operations;
(15) Maintenance history and trending;
(16) Analysis of maintenance-related problems;
(17) Modification work.

Implementing Codes and Standards:

~~BNFL-5193-ISP-01 TWRS-P Project Integrated Safety Management Plan~~
~~Section: 1.3.11 Quality Levels~~
~~Section: 4.2.3 Training and Procedures~~
~~Section: 5.3 Configuration Management~~
~~Section: 5.4 Compliance Audits~~
~~Section: 5.5.5 Mechanical Integrity~~
~~Chapter: 11.0 Organization Roles, Responsibilities and Authorities~~
BNFL-5193-SRD-01 TWRS-P Project Safety Requirements Document
Appendix * Implementing Standard for Maintenance

Regulatory Basis:

29 CFR 1910 Occupational Safety and Health Standards Location: 119 (j) (2)
29 CFR 1910 Occupational Safety and Health Standards Location: 119 (j) (3)
29 CFR 1910 Occupational Safety and Health Standards Location: 119 (j) (4)
29 CFR 1910 Occupational Safety and Health Standards Location: 119 (j) (6)
40 CFR 61 National Emission Standards for Hazardous Air Pollutants Location: 14 (b)
40 CFR 68 Chemical Accident Prevention Provisions Location: 56
DOE/RL-96-0006 4.3.5.1 Operational Testing, Inspection, and Maintenance-Operational Testing, Inspection, and
DOE/RL-96-0006 5.2.7 Mechanical Integrity
WAC 246-247 Radiation Protection - Air Emissions Location: Part 075 (12)

APPENDIX *

IMPLEMENTING STANDARD FOR MAINTENANCE ** [1]

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* Next available appendix letter when incorporated into SRD

** This section is all new; therefore, no redline/strikeout is used.

[1] For a record of tailoring performed in generating this standard, refer to ABAR-W375-00-00007, Revision 0.

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CONTENTS

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DEFINITIONS

The following definitions are intended for use in the NUSS program and may not necessarily conform to definitions adopted elsewhere for international use.

Acceptable Limits. Limits acceptable to the Regulatory Body.

Audit. A documented activity performed to determine by investigation, examination and evaluation of objective evidence the adequacy of, and adherence to, established procedures, instructions, specifications, codes, standards, administrative or operational programs and other applicable documents, and the effectiveness of implementation.

Authorization. The granting of written permission to perform specified activities.

Authorized Limits. See Prescribed Limits.

Commencement of Operation. The beginning of radioactive operations.

Commissioning[1]**.** The process during which facility components and systems, having been constructed, are made operational and verified to be in accordance with design assumptions and to have met the performance criteria; it includes both non-nuclear and nuclear tests.

Competent Authority. A national authority designated or otherwise recognized as such by the Member State for a specific purpose (see Regulatory Body).

Construction (see footnote 1). The process of manufacturing and assembling the components of a facility, the erection of civil works and structures, the installation of components and equipment, and the performance of associated tests.

Decommissioning (see footnote 1). The process by which a facility is finally taken out of Operation.

Design (see footnote 1). The process and the result of developing the concept, detailed plans, supporting calculations, and specifications for a facility and its parts.

Nuclear Safety (or simply Safety). The achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of Site Personnel, the public and the environment from undue radiation hazards.

Operating Organization. The organization authorized by the Regulatory Body to operate the facility.

Operating Personnel. Those members of the Site Personnel who are involved in the operation of the facility.

Operation (see footnote 1). All activities performed to achieve the purpose for which the facility was constructed, including maintenance, in-service inspection, and other associated activities.

[1] The terms, Siting, Design, Construction, Commissioning, Operation, and Decommissioning are used to delineate the six major stages of the licensing process. Several of the stages may coexist; for example, Construction and Commissioning, or Commissioning and Operation.

Operational Limits and Conditions. A set of rules which set forth parameter limits, the functional capability and the performance levels of equipment and personnel approved by the Regulatory Body for safe operation of the facility.

Operational Records. Documents, such as instrument charts, certificates, Log books, computer printouts and magnetic tapes, made to keep objective history of a facility's Operation.

Plant Management. The members of Operating Personnel who have been delegated responsibility and authority by the Operating Organization for directing the Operation of the facility.

Prescribed Limits[2]. Limits established or accepted by the Regulatory Body.

Qualified Person. A person who, having complied with specific requirements and met certain conditions, has been formally designated to discharge specified duties and responsibilities.

Quality Assurance. All those planned and systematic actions necessary to provide adequate confidence that an item or service will satisfy given requirements for quality.

Regulatory Body. A national authority or a system of authorities designated by a Member State, assisted by technical and other advisory bodies, and having the legal authority for conducting the licensing process, for issuing licenses and thereby for regulating facility Siting, Design, Construction, Commissioning, Operation and Decommissioning or specific aspects thereof.[3]

Safety. See Nuclear Safety.

Safety Limits. Limits upon process variables within which the Operation of the facility has been shown to be safe.

Safety Systems. Systems important to Safety[4], provided to limit the consequences of anticipated operational occurrences and accident conditions.

Safety System Settings. Those points of actuation of appropriate automatic protective devices which are intended to initiate action to prevent a safety limit from being exceeded and to cope with anticipated operational occurrences and accident conditions.

Site. The area containing the plant, defined by a boundary and under effective control of the Plant Management.

Site Personnel. All persons working on the Site, either permanently or temporarily.

Siting (see footnote 1). The process of selecting a suitable Site for a facility, including appropriate assessment and definition of the related design bases.

Vendor. A design, contracting or manufacturing organization supplying a service, component or plant.

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[2] The term 'authorized limits' is sometimes used for this term in IAEA documents.

[3] This national authority could be either the government itself, or one or more departments of the government, or a body or bodies specially vested with appropriate legal authority.

[4] See Code 50-C-D (Rev. I).

NOTE ON THE INTERPRETATION OF THE TEXT

When an appendix is included it is considered to be an integral part of the document and to have the same status as the main text of the document.

However, annexes, footnotes, and bibliographies are only included to provide additional information or practical examples that might be helpful to the user.

In several cases phrases may use the wording 'shall consider...' or 'shall..., as far as practicable'. In these cases it is essential to give the matter in question careful attention, and the decision must be made in consideration of the circumstances of each case. However, the final decision must be rational and justifiable and its technical grounds must be documented.

Another special use of language is to be noted: " 'a' or 'b' " is used to indicate that either 'a' or 'b', but also the combination of both 'a' and 'b', would fulfil the requirement. If alternatives are intended to be mutually exclusive, "either... or..." is used.

1.0 INTRODUCTION

Background

101. [deleted]

Objective

102. Effective maintenance is essential for safe operation of a facility. It not only ensures that the level of reliability and effectiveness of all plant structures, systems and components having a bearing on safety remains in accordance with design assumptions and intent, but also that the safety status of the plant is not adversely affected after commencement of operation.

103. Facility maintenance requires special attention because of:

(1) Limitations set by requirements that a minimum number of components remain operable even when the plant is shut down in order to ensure that all necessary safety functions are guaranteed;

(2) Difficulty of access to some plant items even when the plant is shut down, due to radiation protection constraints;

(3) Potential radiological hazards to site personnel and the public.

Scope

104. This Guide covers the organizational and procedural aspects of maintenance but does not give detailed technical advice on the maintenance of particular plant items.

105. It gives guidance on preventive and remedial measures necessary to ensure that all structures, systems, and components important to safety are capable of performing as intended.

106. The Guide covers the organizational and administrative requirements for establishing and implementing preventive maintenance schedules, repairing defective plant items, selecting and training maintenance personnel, providing maintenance facilities and equipment, procuring stores and spare parts, reviewing, controlling and carrying out plant modifications, and generating, collecting and retaining maintenance records for establishing and implementing an adequate maintenance feedback information system.

107. Maintenance shall be subject to quality assurance in all aspects important to safety. Because the subject of quality assurance has been dealt with in detail in other Safety Guides, it is only included here in specific instances where emphasis is required.

108. Maintenance activities are connected to and may also include functional and performance testing of plant, surveillance and in-service inspection. This applies no matter whether functional and performance testing, surveillance, and in-service inspection are carried out by maintenance or other personnel. These activities are, however, covered in other Guides (In-service Inspection for Nuclear Power Plants, IAEA Safety Series No. 50-SG-02, and Surveillance of Items Important to Safety, IAEA Safety Series No. 50-SO-O8). Reference should be made to these Guides and to the programs based on them as guidance to avoid gaps in the overall maintenance program.

Structure

109. This Guide consists of 11 sections and of one annex:

- Section 2 describes the operating organization's responsibility for establishing a program for preventive and remedial maintenance.
- Section 3 deals with the organizational structure of the maintenance group, including the selection and training of maintenance personnel.
- Section 4 gives guidance on administrative control, procedures, and instructions for maintenance.
- Section 5 provides recommendations on maintenance facilities, workshops, special tools, and decontamination facilities.
- Section 6 deals with safety requirements for remedial maintenance and the replacement and repair of defective items.
- Section 7 defines types of modifications and deals with the review, conduct, and independent assessment of modifications.
- Section 8 gives recommendations for establishing suitable organizational units to procure, receive, and store material and spare parts.
- Section 9 contains recommendations to the operating organization on the handling of data from operation and maintenance to ensure the feedback of experience.
- Sections 10 and 11 describe the fundamental quality assurance recommendations for the handling of records and the surveillance, review, and audit program applicable to maintenance.
- The annex provides information relating to the development of work order authorization, equipment work permits, and radiation work permits.

2.0 MAINTENANCE PROGRAM

General Description

201. Before commencement of operation, the operating organization shall prepare a maintenance program for structures, systems, and components important to safety. This program shall be made available to the regulatory body as required.

202. The maintenance program covers all preventive and remedial measures both administrative and technical, necessary to perform maintenance activities satisfactorily. The range of activities includes servicing, overhaul, repair, and replacement of parts and, as appropriate, testing, calibration and inspection (including in-service inspection). It may also include modifications to structures, systems, and components.

203. The operating organization is responsible for establishing a program for preventive and remedial maintenance that will achieve design performance throughout the operational life of the plant. The operating organization may delegate to other organizations the work of establishing and implementing the maintenance program or any part thereof, but it shall retain overall responsibility for such work delegated.

204. The operating organization shall, however, ensure that a maintenance organization is established that includes all the administrative, technical and supervisory functions needed in mobilizing and supervising on-site and off-site maintenance resources. Plant management shall remain responsible for on-site maintenance.

Establishing a Maintenance Program

Because the design and design objectives of facilities have a strong influence on the maintenance program, the development of this program should be initiated sufficiently early in the design phase. The requirements of the maintenance program should be similarly reflected in the final design and construction details of the plant. To accomplish this, the operating organization should arrange for personnel with maintenance experience to consult regularly with the design organization.

206. In addition to defining responsibilities for maintenance during the operating phase, the operating organization should also define in writing the responsibility for maintaining plant items during construction and commissioning so that the program covers:

(1) Plant systems as they are put into operation, and
(2) Plant items that are already installed, but awaiting system completion.

207. The operating organization shall obtain and evaluate timely and sufficient information on maintenance needs from designers, manufacturers, and other operating organizations. It should also ensure that the program is based on good maintenance practice.

208. As early as possible during construction, but not later than the commissioning stage of the plant, a site maintenance group as defined in para. 301 should be established to carry out plant maintenance.

Preventive Maintenance Schedule

209. Preventive maintenance entails pre-planned routine testing, inspection, servicing, and overhaul of structures, systems, and components. Its purpose is to detect incipient failures and to assure the continuing capability of the plant to perform its intended functions. These pre-planned activities shall be specified in a preventive maintenance schedule.

210. Items important to safety shall be included in the preventive maintenance schedule. The operating organization shall review, as appropriate, the lists of structures, systems and components in order to ensure that items important to safety have been properly identified and classified and to ensure that the applicable requirements of the regulatory body have been met.

211. Design bases, design description documents, specifications, the safety report and regulatory requirements shall also be used to identify items important to safety.

212. The frequency and extent of preventive maintenance shall be such as to ensure that the level of reliability and effectiveness of the plant structures, systems and components important to safety remains in accord with the design assumptions and intent, and that the safety status of the plant has not been adversely affected during the period since the commencement of operation. In establishing the frequency and extent of preventive maintenance, the following shall be considered: (a) [deleted], (b) the designer's and vendor's recommendations, (c) the relevant experience available to the operating organization, (d) the probability of failure to function properly, and (e) the necessity of maintaining radiation exposure as low as reasonably achievable (ALARA). The frequency with which structures, systems, and components not normally in use are maintained shall be optimized to prevent possible wearout due to subsequent over-testing and to give confidence that they will satisfactorily perform their functions when required.

213. The preventive maintenance schedule shall be reviewed as appropriate during the life of the plant to take into account operating experience and plant modifications.

214. The frequency and extent of preventive maintenance may be affected by the utilization of predictive maintenance[5] methods. These methods are based on the surveillance of carefully selected parameters and a special analysis of the results. This analysis may be used to justify postponement of remedial actions or anticipation of scheduled maintenance. Such decisions shall only, however, be taken at a suitable, designated level of authority in accordance with arrangements which have been subjected to independent review and approval by the regulatory body if so required. Any decision to postpone or anticipate scheduled maintenance shall also only be taken after ascertaining that violations of operational limits and conditions or other effects detrimental to safety are prevented.

[5] Additional information on predictive maintenance may be found in IAEA Technical Reports Series No. 268, Manual on Maintenance of Systems and Components Important to Safety (Section 3.1).

Design Liaison

215. The aim of close liaison between the operating and design organizations, mentioned in para. 205, should be to ensure that the maintenance program is based on a clear understanding of the design philosophy and plant details, that the plant is designed to facilitate and minimize maintenance, and that any exposure to personnel is kept as low as reasonably achievable (ALARA).

216. The operating organization should arrange for reviews of the design by its staff experienced in maintenance, who should check for design features that could be changed to ease maintenance, particularly in areas of radiological hazard. The review should cover the following:

(1) Access to plant items;

(2) Adequacy of handling devices;

(3) Space available for withdrawal;

(4) Area available for in situ work;

(5) Interference with the operation and maintenance of other structures and systems;

(6) Provision for shielding and access control, both permanent and temporary;

(7) Adequacy of the maintenance and storage facilities considered in Sections 5 and 8;

(8) Adequacy of active drain facilities and ventilation in areas that may be used for temporary maintenance work;

(9) Electrical and mechanical isolation devices;

(10) Draining and venting facilities on active systems;

(11) Adequacy of stocks of spare parts;

(12) Provisions for handling and storing either temporarily or permanently activated or contaminated items, tools, etc., particularly in the controlled area;

(13) Ease of maintenance, of inspection and of decontamination of components during operation;

(14) Suitability of documentation.

The previous experience of the operating organization or of other operating organizations in maintaining equipment and plant should be a factor in the selection of items for review.

217. This close liaison between the operating and design organization should be maintained throughout the life of the facility. It is particularly necessary to ensure effective and timely assistance from the design organization when plant faults occur or modifications are required. For this purpose, the operating organization should arrange feedback of operating experience and reliability data to the design organizations.

Maintenance Planning

218. Because of the complexity of a facility, the activities of different units within plant management interface with one another in ways that are significant for safety. In addition, the large number of special components to be maintained makes successful allocation of on-site and off-site resources needed for effective maintenance a major activity. Maintenance activity has to be planned, therefore, in the context of overall plant management. The maintenance group shall, therefore, work in close consultation with other plant management groups. It is the usual practice for plant management to establish a planning unit to co-ordinate all activities. However, the maintenance group should carry out its own work scheduling within the overall plan. Planning should also ensure that adequate maintenance personnel are available on call to provide urgent remedial maintenance of items important to safety.

219. In planning maintenance activities which involve removal from service of structures, systems and components important to safety, it shall be ensured that operational limits and conditions as well as any other applicable regulatory requirements are still met.

220. The organization for maintenance will vary greatly in different operating organizations, depending on the operating organization's philosophy and practices for operation

221. [deleted]

222. [deleted]

223. Advantage should be taken of any shutdown to undertake maintenance. Appropriate maintenance schedules should therefore be readily available in the event of unplanned as well as planned shutdowns.

224. Since control room personnel are directly responsible for the safe operation of a plant, they shall be informed (e.g. by means of a work permit procedure, see paras. 403—404) of all maintenance work before it commences, any changes to the plant that it entails, and when the plant systems have been returned to the control of the operator. Adequate communication shall be maintained between the maintenance and control room operating personnel during the performance of the work.

3.0 ORGANIZATION AND RESPONSIBILITIES FOR MAINTENANCE

Organizational Structure

301. The plant management shall establish a maintenance group on site to implement the maintenance program. Responsibility for implementing the program shall be delegated to an individual, designated in this Guide as maintenance superintendent. Although the structure of the organization will vary in accordance with national practices and the operating organization's philosophy, there are common factors that influence the choice of structure.

302. The organizational structure for maintenance will depend on the extent to which maintenance and, if applicable, surveillance and in-service inspection, is implemented by the maintenance group, by a central maintenance department of the operating organization, by outside agencies or by contractors. These sources of maintenance personnel can be successfully used in combination. But in every case the maintenance superintendent shall retain primary responsibility for implementing the maintenance program.

303. The maintenance group may be divided into mechanical, electrical, and control and instrumentation sections. The organizational structure below the section heads will depend mainly on which source or combination of sources of maintenance personnel is employed. Examples illustrating two different forms of organizational structures have been given in the Safety Guide on Staffing of Nuclear Power Plants and the Recruitment, Training and Authorization of Operating Personnel, IAEA Safety Series No. 50-SG-01. Those examples, however, are not the only possible alternatives for maintenance; others may be equally acceptable. The structure of the maintenance group, and its integration with off-site resources, depends heavily on such factors as type of plant, local availability of suitable manpower, and regulations governing the employment of off-site labor. In all cases, plant management shall ensure that sufficient numbers of adequately qualified personnel are available to implement the maintenance program.

Responsibilities

304. The responsibilities of the maintenance group management and supervisory staff shall be defined in writing by plant management. Plant management shall ensure that the maintenance group works in close co-ordination with such groups as operations, health physics, quality assurance, planning, fire protection, industrial safety and security. The maintenance superintendent shall ensure close co-operation among the various maintenance sections and any off-site organization involved in maintenance, in order to maximize consistency and effectiveness in planning and implementing maintenance activities.

305. Because of the variety of organizational structures previously discussed, it is not practical in this Guide to define fully the responsibilities of the various managerial and supervisory positions. Nevertheless, regardless of the structure chosen for maintenance and the terms used to define the individual positions, the responsibilities normally include:

(1) *Maintenance superintendent:* implementing maintenance in accordance with appropriate legislation, the policy of the operating organization, the quality assurance program and the guidelines issued by plant management; reviewing and optimizing the preventive maintenance schedule; administering remedial maintenance activities, including initiation of plant modifications where necessary; ensuring availability of adequate maintenance procedures; administering maintenance personnel, including training and qualification; ensuring provision of tools and equipment; reviewing and approving records; reporting to plant management.

(2) *Section heads* (in the area of their responsibility): implementation of maintenance in accordance with the quality assurance program and the instructions of the maintenance superintendent; specification and inventory control of spares; preparation of maintenance procedures and updating of these in the light of experience, e.g. radiation exposure, work methods, available facilities, equipment and tools; provision of adequate supervision of the work, assistance in the administration of maintenance personnel; planning and allocation of resources in accordance with the overall plant requirements; reporting progress and results to the maintenance superintendent; review and approval of reports and records.

(3) *Supervisors* (in the area of work assigned to them): allocation of resources to the various jobs in the daily work, plan; observation of progress and quality of work; assurance that procedures are followed; generation, collation and processing of records; report of work status and progress.

It is the responsibility of the maintenance superintendent, section heads and supervisors to take into account the need to keep exposure of personnel as low as reasonably achievable.

Selection and Training of Maintenance Personnel

306. Staffing for the maintenance group, including selection, training, and qualification of personnel, shall consider provisions of the Safety Guide No. 50-SG-01. Training and qualification shall be in accordance with Section 7.2 of the SRD. The provisions in paras. 309—311 below also apply to outside personnel as appropriate to the type and duration of their job on site.

307. All maintenance personnel shall be made aware of the importance to safety of the tasks they are performing and of the potential safety consequences of technical or procedural errors.

308. Testing and qualification of maintenance personnel shall be integrated into the maintenance program. Testing and qualifications shall be based on an approved and documented process and personnel qualifications shall be documented and traceable. These requirements shall apply both to the permanent staff of the plant and to temporary employees (e.g. contract personnel and off-site personnel of the operating organization.)

309. All maintenance personnel shall be given training in radiation protection, safety rules, access control and emergency procedures appropriate to their duties, and they shall be adequately qualified in these areas before being allowed to work in controlled areas.

310. For special jobs, depending on the nature of the work to be performed, its bearing on the safety of the plant, the related potential risks and consequent required safety precautions, maintenance personnel shall receive a special briefing in addition to the above training. Maintenance personnel shall also be appropriately trained and qualified in the quality assurance requirements applicable to their duties.

311. Selected maintenance supervisors and craftsmen should be given special training, both at manufacturers' works and on site, during construction, fabrication, assembly and testing of particular items important to safety. Arrangements should be made for maintenance personnel to participate in maintenance, inspection, and testing during the construction and commissioning stages.

312. Maintenance craftsmen shall have been trained and shall have initially demonstrated a satisfactory level of craft skill. Certain crafts, such as welding, require periodic requalification and authorization to demonstrate that the individual continues to possess the necessary skills. For this purpose retraining may be necessary. The maintenance craftsmen shall also be trained to understand plant systems and equipment appropriate to their job. Each craftsman should be trained in several areas of the plant to provide flexibility in job allocation. This will not only result in more efficient use of manpower but will also enable variations between the radiation exposures of individuals to be minimized.

4.0 ADMINISTRATIVE CONTROLS

Administrative Procedures

401. In order to implement the maintenance program and achieve the objective of safe reliable operation, plant management shall establish the required administrative controls. These controls will usually be in the form of administrative procedures, which will also include all administrative controls and requirements for carrying out maintenance on the plant. The maintenance program should establish methods to identify the need for maintenance work, for reporting it and for implementing the identified work. Administrative procedures and controls should be established to provide direction to maintenance personnel on the entire maintenance process. The development, review, and approval of administrative procedures shall be in accordance with SRD Section 7.2, "Training and Procedures".

Scope of Procedures

402. Administrative procedures for maintenance shall be sufficiently comprehensive to provide plant maintenance supervision with administrative guidance in all areas of maintenance.

403. The following is a list of some of the administrative controls and procedures to be taken into account when developing documents applicable to maintenance:

(1) General maintenance work criteria and procedures
(2) Generation and control of procedures
(3) Review and revision of procedures
(4) Work order authorization
(5) Equipment isolation work permit
(6) Radiation work permit
(7) Industrial safety control
(8) Fire hazard control
(9) Plant modification control
(10) Training and qualification of maintenance personnel
(11) Material and spare parts control
(12) Lubrication control plan and schedule
(13) Housekeeping and cleanliness
(14) Personnel radiation monitoring
(15) Equipment nomenclature, location and labeling
(16) Preventive maintenance schedule
(17) Generation and collection of records
(18) Retention of records
(19) Maintenance instruction preparation
(20) Shutdown work planning.

Information useful for developing authorizations, permits and certificates needed in administrative control of the tasks mentioned in items (4)—(6) is provided in the annex.

404. In developing the above procedures, account shall be taken of the interfaces between one maintenance activity and other activities such as maintenance on other systems or components, plant operation and radiation protection. In particular, the following aspects shall be explicitly covered:

(1) Delineation of responsibility between those persons performing maintenance and those persons directly responsible for plant operation.

(2) Ensuring that at all time during maintenance activities the operating personnel have adequate information about the plant Status.

(3) The establishment of a work permit system controlling the issue and cancellation of appropriate documentation such as work authorizations, equipment isolation work permits, live testing authorizations, limitations of access, etc. This includes designation of persons in the operating shift to issue such permits to those responsible for carrying out the work.

(4) The provision of a direct positive indication of equipment that is available for operation. This includes tagging where appropriate and any steps to be taken to prevent unintentional restoration to service. Tagging shall not obscure any indication device.

(5) Ensuring that, after maintenance, the structures, systems and components are inspected for correct operational state and, where necessary, tested by authorized persons before their normal operation is resumed.

(6) When work is to be undertaken in controlled areas, work planning and control requirements shall be in accordance with safety criterion 5.0-1 of the SRD.

(7) Ensuring that appropriate dosimetric records are kept and assessed for each job involving radiation hazards, in order to help in future planning and to develop procedures which implement the ALARA principle.

Reference should be made to the Safety Guide on Management of Nuclear Power Plants for Safe Operation, IAEA Safety Series No. 50-SG-09, for further guidance of interface activities between maintenance and operation.

Maintenance Instructions

405. The operating organization shall require plant management to prepare instructions that give detailed directions and controls required for carrying out maintenance. Plant management should delegate the responsibility for preparing these instructions to the maintenance group. These instructions will be normally prepared in cooperation with the designers, the plant and equipment suppliers, and the quality assurance and radiation protection personnel. If persons outside the maintenance group prepare the instructions for routine maintenance, the instructions should be submitted to the maintenance group for approval. The instructions shall be prepared, reviewed by competent persons as appropriate, issued and modified in accordance with established procedures. Plant management shall ensure that the maintenance instructions are correctly implemented and that special provisions are included when particular hazards may be envisaged. The preparation of maintenance instructions shall be in accordance with the safety criterion 7.3-5 of the SRD.

406. Maintenance that can either affect the performance of items important to safety or potentially endanger the health and safety of personnel shall be pre-planned and performed in accordance with properly approved written procedures, instructions or drawings appropriate to the circumstances. However, no maintenance instruction shall direct bypass or removal from service of systems or components if this direction would result in the loss of one or more safety functions or in the violation of the operational limits and conditions.

407. Routine maintenance activities that require skills normally possessed by qualified personnel may not require detailed step-by-step delineation; they shall nevertheless be subject to general administrative procedural control.

408. Exceptionally, performance of a particular job with no maintenance instructions initially available may be authorized by designated persons. Such authorization shall be issued after a proper review by plant management, and on the condition that maintenance instructions are written and appropriately reviewed as the job progresses, and the draft of the instruction is reviewed and approved on job completion before the equipment is returned to normal service.

409. In the process of preparing maintenance instructions, reference documents should be consulted to determine the technical content. These documents should include appropriate drawings, codes, standards, instruction books and manuals provided by the design organization, construction organization, equipment supplier and operating organization.

410. Information in the instruction shall be presented in a logical, step-by-step order and all references and interfaces with other relevant instructions shall be carefully reviewed and verified. The level of detail should be such that the individual responsible for the work can follow the instructions without further direction or supervision.

411. The content and format for a typical maintenance instruction should include the following:

(1) *Instruction identification:* Numbers, letters or combinations of the two that identify each unique instruction as one in the maintenance series. These shall uniquely identify the instruction in all subsequent programs, plans, and records that refer to it.

(2) *Title:* A concise description of the subject of the instruction.

(3) *Purpose:* A brief statement of the scope of job controlled by the instruction.

(4) *Prerequisites:* All special conditions of the plant, system, or equipment status required prior to commencement of work. Any special training or mock-up practice should be noted.

(5) *Limiting conditions:* Any conditions that limit plant operation as a result of carrying out the job, such as load reduction, and operation of stand-by equipment or safety systems. For example, when a system is undergoing maintenance, it shall be considered unavailable for safety purposes unless it can be demonstrated that the ability of the system to perform its safety function has not been diminished.

(6) *Special precautions:* Any special safety instructions such as special radiation protection measures, the need to secure or remove loose items, and any required material control (e.g. incompatible lubricants or chemicals) and environmental conditioning.

(7) *Special tools and equipment:* List of all special tools, rigging, and equipment required to perform the job.

(8) *References:* List of applicable sections of reference documents that may need to be consulted, such as baseline data, drawings, prints, instruction books, manuals, photographs, mock-ups, etc.

(9) *Instruction text:* A sequential step-by-step listing of work details required for the job identifying any changes in radiological conditions as work progresses. At selected steps, craftsmen may be required to sign their names or initials indicating satisfactory completion of the preceding step or steps, either in the instruction or on an attached check sheet.

(10) *Inspection witness points:* Selected points in the work sequence where quality control verification by a competent person is to be made. Work may not proceed past this point until the inspection has been made and documented.

(11) *Return to service:* Actions and checks required to return the equipment or system to an operational condition after certification that the job is complete by the person responsible. Where appropriate, independent check and acceptance criteria should be specified. These include correct reinstatement and correct procedural compliance as well as confirmation of system operability, e.g. valve line-up.

(12) *Operational testing:* Any post-maintenance operational testing required to prove that the equipment is functioning in the intended manner.

Items (11) and (12) are operating functions and may be included either in the maintenance instruction or in a special interfacing operating instruction.

412. The format of maintenance instructions may vary depending on the purpose of the document and the practices of the operating organization.

413. It is essential to document a brief but understandable review of the repairs carried out, explicitly identifying the cause of failure, the remedial action taken, the component that failed and its mode of failure, the total repair time and the outage time (if different) and, finally, the state of the system after repairs.

Control of Contracted Activities

414. Maintenance activities performed by contractors and other personnel who are not permanent plant employees shall be controlled by established administrative procedures and management control. These controls shall address training, qualification, and selection of contractor personnel, radiation protection, procedure usage, understanding of plant systems, and applicable administrative procedures for both normal operation and emergency conditions. The plant maintenance organization shall be responsible for assuring the quality of contractor work and any necessary channels of accountability. Supervising plant personnel shall be properly trained and made aware of their responsibilities with respect to the safety of plant systems involved.

5.0 MAINTENANCE FACILITIES

Workshop Facilities

501. The operating organization shall provide adequate workshop facilities with sufficient space and equipment to carry out maintenance effectively; availability and intended use of off-site facilities and the need to deal with radioactive plant items shall be taken into account. On-site workshops shall be provided for mechanical, electrical, control, and instrumentation equipment.

502. Each of the workshops should include the following:

(1) Office area (if not already provided elsewhere), including facilities for the processing and storage of records and procedures;

(2) Fitting and overhaul area, with suitable work benches for disassembly, repair and reassembly of plant items that are intended to be dealt with in the workshop;

(3) Secure storage facilities for special tools and testing equipment required for maintenance.

503. On-site or off-site facilities should include at least:

(1) Mechanical shops

(i) Space and equipment for welding, sheet metal and plate fabrication, pipefitting and handling of heavy equipment and material

(ii) Machine tools such as lathes, milling machines, shapers, pedestal drills, grinders and presses

(iii) Clean room with lapping, polishing and surface checking equipment

(2) Electrical shops

(i) Test benches with the appropriate power supplies connected
(ii) Motor overhaul and test facility
(iii) High voltage test area with controlled access
(iv) Instrument and relay testing and calibration facilities
(v) Small coil rewind facility

(3) Control and instrumentation shops

(i) Test benches with the necessary electrical, electronic, pneumatic and hydraulic supplies and test equipment

(ii) Calibration and testing facilities for instruments and controls

(iii) Facility for safe fault finding on energized equipment

(4) Other facilities

(i) Facilities for acceptance testing of overhauled/replacement equipment, as necessary

(ii) Preventive maintenance tools such as vibration analyzers, bearing monitoring tools and non-destructive testing facilities.

Facilities for Maintenance on Radioactive Items

504. It may be impractical or impossible to decontaminate some plant items sufficiently to allow them to be maintained in the general workshops. In such cases and also for the maintenance of irradiated items, special maintenance facilities shall be provided to keep radiation exposure to individuals as low as reasonably achievable and to prevent the spread of contamination. This may be accomplished by providing specific maintenance facilities for particular single plant items and providing a workshop, located within the controlled area, for work on radioactive parts that can be brought to it.

505. Plant management may occasionally find it necessary to supplement the above permanent arrangements by erecting a temporary facility around a plant item or a machine tool.

506. Whichever facility is provided, the following need consideration:

(1) Access control and changing rooms
(2) Ventilation with filtered discharge
(3) Treatment, handling and disposal of liquid radioactive wastes
(4) Treatment, handling and disposal of solid radioactive wastes
(5) Equipment for radiation monitoring and protection
(6) Shielding and remote handling equipment
(7) Provision for storing radioactive items, with non-conforming items segregated from conforming items
(8) Decontamination requirements.

Decontamination Facilities

507. The operating organization shall provide facilities for removing radioactive contamination from plant items, tools and equipment prior to maintenance or other disposition. These facilities should include the following features:

(1) Access control and changing rooms;

(2) Ventilation with filtered discharge;

(3) Treatment, handling and disposal of liquid radioactive wastes;

(4) Treatment, handling, storage and disposal of solid radioactive wastes;

(5) Equipment for radiation monitoring and protection;

(6) Decontamination tanks and special equipment to deal with the largest plant item, likely to require decontamination;

(7) Adequate supplies of electrical power, steam, hot water, compressed air and appropriate chemical decontamination agents;

(8) Other decontamination systems such as those for glass blasting or ultrasonic techniques.

508. Experience in operating plants shows that these facilities are frequently inadequate. Changing rooms and decontamination facilities should therefore be provided to accommodate maximum usage in periods of intensive maintenance work.

509. In some cases, it may be desirable to proceed with local decontamination of individual components without removing and bringing them to the decontamination facilities. Suitable equipment and instructions shall be provided and validated in order to prevent damage to any equipment and undue exposure of personnel and spread of contamination.

Special Facilities

Mock-Ups

510. In some cases there are maintenance advantages in designing and constructing simulations, mock-ups or models of particular sections of the plant, either full size or reduced, in areas remote from the section of the plant concerned. Such facilities are particularly recommended for:

(1) Rehearsing work to be carried out in high radiation areas or on highly contaminated plant items, particularly for personnel not familiar with the plant or for an unusual or specialized job

(2) Preparing and validating procedures, to avoid errors and reduce exposure

(3) Gaining experience with tools and protective equipment in simulated working conditions

(4) Developing and improving tools and equipment

(5) Training and qualifying personnel for selected work.

Special Equipment and Tools

511. In addition to the special equipment essential to maintenance, plant management shall provide special equipment and adequate training for its use where it can significantly reduce radiation exposure or improve safety. Examples of special equipment that has proved necessary or helpful are:

(1) Remote handling manipulators and remotely operated special purpose tools;

(2) Automatic welding and cutting equipment;

(3) Remotely operated non-destructive testing equipment;

(4) Automatic in situ valve set lapping machine;

(5) Remote viewing equipment such as mirrors, binoculars, telescopes, periscopes, boroscopes, fibroscopes, closed circuit television and remotely operated cameras;

(6) Communication systems such as direct line telephones, radio and communication equipment for use when respiratory protection is being worn;

(7) Special containers for contaminated items;

(8) Shielded containers and portable shielding;

(9) Radiation protection clothing and equipment;

(10) Material and equipment for controlling and containing radioactive contamination; examples include plastic sheeting and tents, paper floor covering, suction cleaners and floor cleaning equipment;

(11) Fixed or rapidly assembled access equipment to reduce personnel exposure, such as permanent ladders or telescopic cradles.

Photographic and Video Records

512. During plant construction, the operating organization should ensure that comprehensive photographic and (where appropriate) video records are compiled, particularly of plant areas that will eventually be inaccessible or subject to high radiation levels. These visual construction records of as-built conditions should show identification marks and be comprehensively catalogued with descriptive captions. This will ensure that similar photographs and tapes taken during subsequent inspections or maintenance work can be easily compared and will assist any work planning and personnel familiarization undertaken before the start of maintenance work.

513. The operating organization shall ensure that adequate facilities, space and clear access are provided in the design of the plant for all plant items that are likely to require removal and transport.

514. Plant management shall provide suitable portable lifting and transport facilities with clear indications of lifting capacity. In the selection and use of these facilities, due account shall be taken of the radiological consequences of failure. Examples of precautions taken include regular examination and maintenance of lifting equipment, periodic testing and special inspections before major lifting and rigging operations and cautions limiting movements of loads over specified areas.

515. Special consideration should be given to the use of mobile lifting and transport facilities as a possible means of substantially reducing personnel exposure (e.g. filter removing equipment).

6.0 REPLACEMENTS AND REPAIRS

Remedial Maintenance

601. The maintenance group should be capable, with the assistance of outside agencies if necessary, of restoring the plant to its normal operational capability by remedial maintenance such as replacement or repair of defective plant items.

602. The need for remedial maintenance may arise when deficiencies or failures are noticed during plant operation. Anticipating such cases, plant management shall draw up appropriate procedures, e.g. work order authorization and equipment isolation work permit procedures, including procedures detailing how such failures are to be reported to the maintenance group and how plant items are to be withdrawn from service for remedial maintenance. These procedures should require operating personnel to assign priority to remedial work on the basis of its importance to safety, taking into account the operational limits and conditions as well as the necessity of preventing the loss of any safety function.

603. After any remedial maintenance is completed, a brief report of the repairs or replacements carried out should be prepared, identifying the component that failed, its mode of failure, the remedial action taken, the total repair time, the total outage time and the state of the system after the remedial maintenance work.

604. The maintenance group shall periodically review the maintenance records for evidence of incipient or recurring failures. When the need for remedial maintenance is found either during this review or during preventive maintenance of the plant, the maintenance group shall initiate remedial maintenance in accordance with the administrative procedures referred to above. The preventive maintenance program shall be revised accordingly.

Replacing Defective Items

605. When remedial maintenance can be most conveniently accomplished by substituting a proven identical spare for the defective plant item, it shall be done in accordance with established procedures such as those for issuing work order authorizations. A defective plant item not suitable for subsequent repair shall be disposed of by a documented process that prevents reuse. Defective components should not be allowed to accumulate in work areas.

606. When a defective item has been replaced, suitable functional or performance tests shall be carried out in conjunction with the operating personnel; the tests shall be documented and the results recorded. The plant item shall be returned to service or stand-by duty in accordance with established procedures such as that for issuing equipment isolation work permits.

Repairing Defective Items

607. The repair of defective items, whether removed from the plant or not, shall be done in accordance with established procedures such as those for issuing equipment isolation work permits and work order authorizations as appropriate.

608. When plant repairs consist of more than merely replacing parts and components by identical spares, a review shall be made as to whether the repair will involve changes sufficient to require application of the plant modification control procedure described in Section 7.0.

609. If repairs are made in situ, the post-maintenance testing and procedures for returning to service shall be as described in para. 606 above.

610. Plant items that have been repaired in the workshop shall be inspected and tested to ensure, as far as possible, full return to serviceability. If testing cannot be completed in the workshop, cautionary labels or tags shall be applied to the plant item to warn that testing still has to be completed before reuse. When these post-repair processes are complete, items not intended for immediate installation should be returned to stores through normal receiving channels.

7.0 MODIFICATIONS

Types of Modification

701. Modifications may be necessary to rectify component failures discovered during maintenance, to repair components following failures in operation, to reduce the frequency of faults, to improve maintainability or to incorporate a non-identical replacement plant item. They may also result from experience in other facilities, from new knowledge or from regulatory requirements. Modifications may affect structures, systems and components, operational limits and conditions, instructions and procedures, or a combination thereof.

Review Requirement

702. Modifications shall be planned and conducted in accordance with safety criteria 4.0-1 and 4.0-2 of the SRD. Therefore, the operating organization shall arrange for a first review of a proposed modification to ascertain if it affects safety. Where a proposed modification is judged to affect safety, a further independent review and assessment shall be carried out and the proposed modification shall then be submitted to the regulatory body for prior approval, if so required. In any case, when modifications of the operational limits and conditions are also involved, the proposed modification shall be submitted to the regulatory body for prior approval.

703. In order to facilitate the first review mentioned in para. 702, the operating organization should specify those plant items and systems (such as emergency electrical supplies) that are considered in any case important to safety.

704. The above mentioned directive should allow for rapid review and assessment of any proposed modifications that have to be undertaken urgently; nevertheless, such emergency action shall not reduce levels of safety. In these circumstances, retrospective formal documentation shall be completed without undue delay.

705. A suitable procedure, e.g. plant modification control procedure, issued by the plant management, should clearly allocate responsibility for coordinating plant modifications, implementing the on-site classification and review process, liaison with the independent assessment process, administering controls relating to the implementation and documentation of approved modifications, and disseminating information to specified bodies.

706. Except when explicitly required by established procedures, the configuration of structures, systems and components important to safety shall not be altered (such as by defeating interlocks, installing jumpers, etc.) without written orders by authorized persons. In any case such alteration shall not violate operational limits and conditions. Any alteration shall be reviewed by competent persons as soon as possible and if the alteration is considered to be of a permanent or repetitive nature, appropriate approval of the regulatory body shall be obtained, if so required.

Submission of Proposals

707. Proposals for modifications submitted by plant management for independent assessment shall comply with requirements specified by the operating organization in accordance with quality assurance requirements. The submissions shall specify the functional and safety requirements of the proposed modifications and show how these requirements are met. The amount of information needed will depend on the extent and complexity of the modification but, as a general guide, submissions should include the following as necessary:

(1) Design description and reason for modification;
(2) Safety analysis and proposed modification of the operating limits and conditions, if any;
(3) Sketches, drawings and materials list;
(4) Specifications requirements for parts and materials;
(5) Applicable codes, standards and safety report section;
(6) Fabrication, installation and test methods;
(7) Operational state of the plant, or parts thereof, required to implement the modification;
(8) Adverse environmental or operating conditions;
(9) Quality assurance requirements.

708. The proposal shall include an assessment of the effect of the modification on the radiological hazard during its implementation, and during subsequent commissioning, testing, maintenance, operation and decommissioning of the modified plant. This assessment shall include the effect of the modified plant item and its associated system on physically adjacent systems and plant items, and interconnected systems such as power supplies.

709. The proposed modification shall conform to the provisions set forth in the safety analysis report. In any case, the proposal shall demonstrate that the modification meets the original system specification or that the new system specification is better.

710. When so required, the proposed modification shall be submitted to the regulatory body for approval before implementation.

Implementation and Documentation

711. All reviews and assessments shall be documented, and only those modifications that have successfully gone through the appropriate processes shall be approved for implementation. Implementation of modifications shall be subject to the usual maintenance administrative procedures together with any special requirements generated by reviews and assessments.

712. As a consequence of a modification, the list of spare parts to be kept in stores shall be reviewed and updated so that the necessary new spare parts are procured and those spare parts that no longer conform are dealt with either by modification or disposal.

713. The above mentioned directive shall make plant management responsible for recording approval and implementation of modifications, for amending records of plant design, and for updating drawings, procedures and instructions. These requirements should be implemented in accordance with steps set out in the plant modification control procedure.

8.0 STORES

Organization

801. The operating organization shall establish suitable organizational units to procure, receive, store, and issue materials, spare plant items and components for use with systems important to safety. The unit receiving, storing and issuing such items on site should be responsible to the plant management. The procurement unit may also be responsible to plant management or be located elsewhere to serve a number of facilities; in the latter case, the operating organization shall ensure that there are written procedures to control the interface between the off-site procurement units and plant management. These procedures shall clearly define who has the authority for specifying technical and quality assurance requirements and for selecting suppliers. When that authority is vested off site, the procedures should require consultation with, and approval by, the plant management. Whatever the organizational structure, the operating organization should issue criteria to identify items important to safety, establish written procedures to cover these activities and provide appropriate training on quality assurance for the personnel involved.

802. The unit for receipt, storage, and issue of items important to safety shall have its responsibilities defined in writing by plant management. A satisfactory arrangement would be for personnel in charge of the stores to be responsible to the head of an on-site procurement unit who also should be the officer administering the interface with the off-site procurement unit. If plant management considers allocating this responsibility to an administration group, suitable procedures will be necessary to ensure that this group responds to the requirements of the maintenance group.

803. The maintenance group shall be responsible for ensuring it has adequate spares, tools and resources to achieve its objectives; it shall also be responsible for establishing stock levels and authorizing the issue and use of spares.

Procurement

804. The operating organization should arrange to purchase appropriate quantities of spare plant items and components for systems important to safety. These spares shall meet the same technical standards and quality assurance requirements as the equivalent installed plant items, but with additional requirements for ensuring adequate protection during long term storage.

805. The quantities of initial spares to be purchased in this way should be approved by plant management after consulting with the vendor and taking account of relevant maintenance experience available to the operating organization. Factors to be considered include the number and importance of major plant items that could be subject to serious failure; the special nature of any manufacturing process that would preclude subsequent manufacture of a plant item; the uncertainties in future supply of parts and components currently available; anticipated delivery times; the estimated duration of repairs to a plant item compared with the unavailability time of the item permitted by the operational limits and conditions; and the shelf life of the component.

806. Procurement of plant spares, materials parts, and components shall be in accordance with the provisions of safety criterion 7.3-11 of the SRD. Deviations from the original specification, however minor, should not be permitted until the change has been referred to plant management for consideration under the procedure established for plant modifications described in Section 7.

807. It should be the responsibility of the purchasing unit to ensure that materials and items are obtained only from suppliers who are approved in accordance with the requirements of safety criterion 7.3-11 of the SRD.

808. Routine reordering of material and plant items already held in store should be initiated automatically in accordance with written procedures when a pre-determined lower stock limit is reached. This limit should be based on the expected or known rate of use and the anticipated delivery time or shelf life. The purchasing unit shall ensure, by means of documented reviews at the time of reordering, that the technical and quality assurance requirements have been updated as appropriate and incorporated into routinely generated procurement documents.

809. Procurement of maintenance items not held in store should be initiated by the maintenance group. This group should be responsible for ensuring, in accordance with an established procedure, that the technical and quality assurance requirements are correctly established and specified to the purchasing unit. It should be the responsibility of the purchasing unit to ensure that these technical and quality assurance requirements are then incorporated into the procurement documents without change.

Receipt

810. The operating organization shall provide adequate facilities for receiving on site all materials, spare parts and components for items important to safety. The facilities for receipt should include equipment for safe, convenient handling and sufficient space with appropriate environmental conditions for proper receipt inspection. A separate and secure quarantine area should be provided for temporary retention of stores not cleared for final storage or issue.

811. Plant management shall allocate in writing the responsibility for receiving all stores on site and should issue a special procedure to control the receipt and acceptance process. This procedure should include visual external inspection for transit damage or deterioration and verification of correct packaging and identification. Items found incomplete, incorrect or having inadequate documentation should not be accepted for final storage. The procedure shall also include a requirement to label or tag such items until non-conformance is resolved.

Storage

812. The operating organization shall ensure that storage facilities offer adequate space and provide for secure retention of stores in environmental conditions and suitable configurations designed to prevent lowering of quality through external effects or deterioration. Access and installed handling equipment shall be adequate for the type and size of items to be stored.

813. Plant management shall make administrative arrangements to ensure that the storage facility is operated in a manner that preserves the correct environmental conditions, guards against fire hazards and prevents unauthorized access to stored items. The stored items should be arranged so that regular examination of all stored items may be conveniently accomplished, where necessary, with suitable handling equipment.

814. The administrative arrangements should include written procedures allocating responsibility for regularly examining stored items and auditing store administration to detect deterioration and unauthorized or unrecorded use of stored items. Particular attention should be paid to the retention of the original identification of items during storage.

815. In the procedure relating to modifications, plant management should include steps to initiate, control and record the modification of spare plant items following modification to equivalent items installed in the plant.

816. If the packaging of items incorporates protection against deterioration in storage and it is found necessary to invalidate that protection, for example to modify or inspect the item, then the protective function shall be restored or deterioration prevented by some other equivalent means.

817. Items which have a limited lifetime shall be timely and regularly replaced if not used, to ensure suitability for the expected service when needed.

Issue Requirements

818. Storage facilities shall provide for convenient and orderly issue of stores. This is normally done with the aid of a counter, or barrier through which the issue of stores can take place without contravening arrangements for security and correct environmental conditions.

819. Stored items shall only be issued by authorized persons in response to written orders presented by persons having authority to receive the stored items. Appropriate records should be generated to document the ultimate disposition of issued items to facilitate tracing. The issuing procedures shall require that excess or unused items be returned to stores in accordance with normal receipt practice.

820. Unless organizational arrangements allow continuous access to the store, e.g. full shift staffing, the procedures should permit emergency issue of urgently required stored items on the authority of and under the control of the shift supervisor, in a manner compatible with the normal issuing process.

9.0 FEEDBACK OF EXPERIENCE

901. Maintenance experience data collection and analysis are necessary in order to enhance the safety of the plant and reliability of structures, systems, and components throughout their operating life. Significant events, but also minor incidents, may reveal important deficiencies or negative trends adverse to safety.

902. Therefore, a process for collecting, classifying and evaluating abnormal events or findings concerning maintenance, and for feeding back the results of the lessons learned from experience into the design and the operation of facilities is considered to be of paramount importance.

903. The operating organization shall arrange for:

(1) Collecting, evaluating, classifying and recording abnormal events or findings, in order to detect precursors, common mode failure mechanisms, deficiency of equipment or personnel;

(2) Transferring to the design groups the experience of actual maintenance in order to enable future designers to improve plant features which have a bearing on the maintenance activity, such as ease of access, ease of disassembly and reassembly, and implementation of the ALARA principle;

(3) Utilizing maintenance experience in the training of maintenance personnel;

(4) Validating reliability data collection to be used for probabilistic evaluations and for the technical specification of new components;

(5) Ensuring retrievability of data and proper transfer of the relevant information to the appropriate persons or organizations.

904. The participation in national and international data banks is also considered to be a positive means of implementing the objectives of such transfer of experience.

10.0 RECORDS

Generation and Collection of Records

1001. Appropriate arrangements shall be made for the orderly collection of records and the production of reports on maintenance activities. Records and reports are required to provide objective evidence that the maintenance program is being implemented fully in accordance with the quality assurance program. In addition, maintenance records such as equipment history cards and the results of maintenance work are a necessary input to a continuing review of maintenance effectiveness, which should be the responsibility of the maintenance group. Another important use of maintenance records is the generation of data for reliability studies.

1002. Both purposes can be served by suitable arrangements to generate and collect the same records, but the controlled copy used for quality assurance purposes shall be processed in accordance with safety criteria 7.3 of the SRD.

1003. The maintenance instructions should be designed to facilitate the convenient generation of records. In general, records shall identify the maintenance and operational personnel concerned and include certification by supervisors or inspectors as appropriate.

1004. A classification system that identifies the plant item and system facilitates feedback of data to the appropriate bodies and provides data on component reliability.

Retention of Records

1005. The maintenance organization should be required by an administrative procedure to select records that give a meaningful plant history and to retain them for the life of the plant. Other records that have only a transitory value should be retained either until they cease to serve the purpose for which they were originally intended or are replaced by later records. An important factor in selecting records to be retained is their use in assembling reliability data.

1006. The retention of records required for quality assurance purposes shall be in accordance with safety criteria 7.3 of the SRD.

1007. The record should consist of originals, hard copies, microfilms, or computer storage. In all cases, ease of retrievability commensurate with the likely need for consultation and review, and the need to guard against accidental loss shall be taken into account when establishing storage facilities.

11.0 SURVEILLANCE, REVIEW, AND AUDIT PROGRAM

Need for a Program

1101. The operating organization shall establish a program of surveillance, review and audit of maintenance in order to ensure that the maintenance program meets its purpose and has been implemented in accordance with the design intent, with regulatory codes and requirements and with the operating organization's own procedures and policies.

Surveillance Procedures

1102. Verification inspection of maintenance activities shall be carried out by appropriately qualified individuals who do not have direct responsibility for performing the work. The inspector may be a member of the same organizational unit, and a supervisor may serve as the inspector if he or she did not personally participate in the work. Inspections may be unannounced and should include direct observation of the specific maintenance activity as well as examination of documentation. The results and findings of these inspections shall be transmitted to the appropriate maintenance supervisors for information and for corrective action if required.

Maintenance Review

1103. The operating organization shall establish a program for reviewing the maintenance activities. Responsibility for this review program shall be assigned by the operating organization.

1104. It is suggested that impartiality of the maintenance review be achieved by bringing in various department heads from plant management. Additional expertise may be obtained from off-site personnel.

1105. The review program shall examine the maintenance program for features such as:

(1) Adequacy of the preventive maintenance schedule and its implementation
(2) Response to remedial maintenance requirements
(3) Satisfactory control of radiation doses
(4) Availability and effective use of resources
(5) Level of training and experience
(6) Adherence to quality assurance requirements
(7) Adequacy of procedures and instructions
(8) Effectiveness of the reviewing function within the program.

1106. The findings of the review program should be reported periodically to the maintenance group, plant management and selected members of the operating organization and actions should be taken to maintain or improve plant safety and performance, as appropriate.

Audit Programs

1107. The operating organization shall establish an audit program for the maintenance activity. These audits shall be performed by qualified personnel who have no direct responsibility for maintenance. The audits will determine whether or not the maintenance activity is being conducted in compliance with regulatory requirements and the operating organization's policies and quality assurance program.

1108. Audits shall be performed at specified intervals by qualified audit teams and shall cover all areas of the maintenance activity that could affect items important to safety. Audit details shall be in accordance with safety criterion 7.3-10 of the SRD. The audit reports shall be sent to plant management and selected members of the operating organization for action or information, as appropriate.

1109. Personnel in the maintenance group should occasionally be assigned to audit teams auditing other areas of plant activity. This experience will enhance their understanding of quality assurance requirements in their own activities.

Annex

ADMINISTRATIVE ASPECTS OF MAINTENANCE WORK

A.1. This annex is intended to provide information useful for developing authorizations, permits, and certificates needed in administrative control to ensure safety in the work area and to prevent maintenance activities from affecting other aspects of safety. It deals specifically with the items listed in para. 403, of this Guide, namely:

Item (4) — Work order authorization
Item (5) — Equipment isolation work permit
Item (6) — Radiation work permit

and it also addresses those aspects of item (8), fire hazard control, and item (9), plant modification control, which are inseparable from the above items.

A.2. These authorizations, permits and certificates generally:

(a) Define the plant item, the type of work to be performed, and the boundaries of the working area in which the activities of plant personnel are authorized.

(b) Confirm that the plant item is either in a safe condition to work on, or conforms to conditions set out in the prerequisites of written procedures appropriate to the authorized work. These conditions should specify any precautions that need to be taken.

(c) Confirm radiological conditions in the work area, note any other possible hazards, and specify any precautions to be taken in order that the authorized work may be carried out.

(d) Confirm that all personnel have been withdrawn from the working area after the authorized work is completed, and the plant item can either be returned to service or remain in a known condition.

(e) Include self-cancellation features by indicating the conditions of validity, e.g. time limits.

A.3. This annex does not relate to controls required to avoid incorrect maintenance of the plant item. These are covered in paras 405-413 (maintenance instructions), which should be considered together with associated quality assurance requirements detailed in Section 7.3 of the SRD.